# A typology of stress in Spanish non-verbs

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**Abstract**

This article discusses the topic of stress in Spanish and its relationship to a higher metrical category called the foot. A general typology couched in the theoretic architecture of Optimality Theory is provided. I argue and illustrate that all stress patterns in Spanish non-verbs can be justified by a ranking schema of constraints which first govern the shape of metrical feet, and later determine the alignment of these feet to the syllable.

**Keywords:** Stress assignment, Spanish, Optimality Theory.
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# 1 Introduction to Spanish stress patterns

In this article stress is defined in terms of relative prominence in relation to the other syllables contained in the word. In the disyllabic token *pato* 'duck', [pa.to], for example, primary stress falls on the [a], denoted by the application of the acute accent mark «ˊ» [pá.to]. Some words may also contain secondary stress which is exclusive to the phonetic level. Consider the word *mariposa* 'butterfly'. Apart from primary stress, which applies over the penultimate vowel [o], this word also contains secondary stress over the first vowel [a], depicted using a grave accent mark «ˋ», [mà.ɾi.pó.sa][1]. Consider the primary stress in the following examples:

(1) Primary stress in Spanish words

a. Stress over ultima syllable (oxytones –O#)

| | | |
|---|---|---|
| *balcón* | [bal.kón] | 'balcony' |
| *tabú* | [ta.βú] | 'taboo' |
| *sofá* | [so.fá] | 'sofa' |
| *riñón* | [ri.ɲón] | 'kidney' |
| *hostal* | [os.tál] | 'hostal' |
| *pilar* | [pi.lár] | 'pilar' |
| *liquidez* | [li.ki.ðéθ] | 'liquidity' |

b. Stress over penultima syllable (paroxytones –PO#)

| | | |
|---|---|---|
| *pato* | [pá.to] | 'duck' |
| *nata* | [ná.ta] | 'heavy cream' |
| *patata* | [pa.tá.ta] | 'potato' |
| *zapato* | [θa.pá.to] | 'shoe' |
| *resumen* | [re.sú.men] | 'summary' |
| *examen* | [ek.sá.men] | 'exam' |
| *germen* | [xéɾ.men] | 'germs' |
| *abdomen* | [aβ.ðó.men] | 'abdomen' |
| *líder*[2] | [lí.ðeɾ] | 'leader' |
| *tórax* | [tó.ɾaks][3] | 'thorax' |
| *lunes* | [lú.nes] | 'Monday' |
| *túnel* | [tú.nel] | 'tunnel' |

c. Stress over antepenultima syllable (proparoxytones –PPO#)

| | | |
|---|---|---|
| *régimen* | [ré.xi.men] | 'diet' |
| *espécimen* | [es.pé.θi.men] | 'specimen' |
| *estímulo* | [es.tí.mu.lo] | 'stimulus' |
| *ridículo* | [ri.ði.ku.lo] | 'ridiculous' |
| *espectáculo* | [es.pek.tá.ku.lo] | 'spectacle' |

[1] It is generally accepted that secondary stress has no phonological impact in Spanish.

[2] Although this word is a loan from English, its plural form, líderes, tells us that it is a *naturalized* loan and therefore is valid for our analysis.

[3] Full realization of [k] is hypercorrect.

| | | |
|---|---|---|
| *músculo* | [mús.ku.lo] | 'muscle' |
| *máximo* | [mák.si.mo] | 'maximum' |
| *mínimo* | [mí.ni.mo] | 'minimum' |
| *Wáshington* | [wá.ʃiŋ.ʈon] | 'Washington' |
| *Rémington* | [ré.miŋ.ʈon] | 'type writer' |

Focus on the syllable which receives primary stress in monomorphemic words containing the alternating diphthongs [we] and [je]:

(2) Stress in words with alternating diphthongs[4]

| | | |
|---|---|---|
| *bueno* | [bwé.no] | 'good' |
| *abuelo* | [a.βwé.lo] | 'grandfather' |
| *huérfano* | [wér.fa.no] | 'orphan' |
| *tuétano* | [twé.ta.no] | 'marrow' |
| *riesgo* | [rjés.ɣo] | 'risk' |
| *prieto* | [prjé.to] | 'tight' |
| *hierba* | [jér.βa] | 'grass' |

As the data in (1) illustrate, stress in Spanish non-verbs may not appear beyond the third syllable from the rightmost edge of the prosodic word. Harris (1983) formalizes this generalization, asserting stress assignment in Spanish is severely restricted to a three syllable window of sorts in which stress must apply.[5] Indeed, this seems to be one of few steadfast rules which is never violated by Spanish stress application.

In a majority of the cases, the assignment of primary stress coincides with the appearance of the alternating diphthongs [we] and [je], although this is not an altogether trustworthy generalization: *arriesgar* [a.r(je)s.ɣár] 'to risk', *amueblar* [a.m(we).βlár] 'to furnish', *deshuevar* [des.we.βár] 'to castrate' (Alonso-Cortés 1997).

The fact that stress may fall on any one of the final three syllables of a Spanish word does not mean that distribution is not, at least partially, predictable. Consider the following data extracted from Núñez Cedeño's and Morales-Front's electronic examination of 91,000 Spanish words (Núñez Cedeño & Morales-Front 1999, 211). Here stress is organized according to the final segment:

(3) Statistics from 91,000 Spanish non-verbs

| Word typology and stress patterns | % of total words |
|---|---|
| V# O# | 0.87% |
| V# PO# | 88.00% |
| V# PPO# | 11.10% |
| C# O# | 97.80% |
| C# PO# | 2.03% |
| C# PPO# | 0.05% |

[4]The alternating diphthongs [je] and [we] are invariably stressed in monomorphemic words, while other rising diphthongs can remain unstressed, *contiguo* [kon.tí.gwo] 'contiguous' for example.

[5]Roca (2006) provides an OT constraint which expresses this detail.

There is a general consensus in the phonological literature that Spanish is a trochaic language, meaning that stress can be described in terms of a disyllabic pattern, known as a foot, in which primary stress falls on the leftmost syllable. The data presented in (3) support such a claim. Further, the pronunciation of certain household products of foreign origin such as *Colgáte* (*Colgate* toothpaste) and *Palmolíve* (*Palmolive*, brand of soap), as well as the distribution of stress in certain acronyms such as ÓNU, ÓTAN and ÚSA (U.N., NATO and U.S.A.) corroborate the assertion that the default stress pattern in Spanish nominals is indeed trochaic (Roca 2006).

Although 97.8% of the Spanish non-verbs which end in consonants are oxytone, a noteworthy majority of Spanish non-verbs in fact end in vowels, the most common word-final vowels being [a,o].

The more important data here illustrate that, of the total words which end in a vowel, 88% exhibit paroxytone (trochaic) stress. And since this category, words that end in a vocalic segment, constitutes the larger of the two categories, as opposed to words that end in a consonant, it is logical to assume that the preferred, and therefore unmarked, stress pattern in Spanish non-verbs is trochaic. In past studies, this generalization has been captured by a constraint TROCHEE, which requires that stress apply over the leftmost syllable of a disyllabic foot:

(4) TROCHEE
Feet are either monosyllabic or disyllabic. If the foot is disyllabic then the head is on the left.

Offering a further interpretation of the data in (3), certain assumptions concerning the markedness values of the stress patterns can be made. First, it can be deduced, as Roca (2006) does, that PPO# structures which end in a consonant are *super marked*, while those ending in a vowel are simply *marked*. PO# and O# can be marked but are not necessarily so, depending on the final segment of the word.

Additionally, it must be mentioned that stress in Spanish is contrastive, meaning that minimal pairs, or even triplets, emerge according to the position of stress:

(5) Minimal pairs as a result of stress application

| | | | |
|---|---|---|---|
| Ultima | *especificó* | [es.pe.θi.fi.kó] | 'he/she/it specified' |
| Penultima | *especifico* | [es.pe.θi.fí.ko] | 'I specify' |
| Antepenultima | *específico* | [es.pe.θí.fi.ko] | 'specific' |

The preceding data intimate a paradigm of indisputable interaction between stress assignment, syntactic affiliation and lexical access.

The systematic behavior of stress application has led phonologists to posit the notion of a higher stratum of stress interaction in which stressed and unstressed syllables are organized into a structural unit called a metrical *foot*. Below both intuitive as well as empirical evidence to support this view is examined.

## 1.1 An intuitive argument for the foot as an autonomous prosodic constituent

Stress in Spanish is organized and emerges systematically, corroborating the argument that its distribution is governed by universal principles of natural language and cognition more generally. The fact that native Spanish speakers may manipulate stress patterns for non-communicative purposes verifies this claim. Consider the process of name truncation in Spanish. In an extraordinarily high number of the cases, truncated name forms are parsed into trochaic feet, meaning that stress emerges over the leftmost syllable of a disyllabic foot. Remarkably, this is even the case when stress is forced to shift to accommodate the trochaic structure. Consider the following data:

(6) Truncated forms of Spanish names[6]

| | | |
|---|---|---|
| *Maite* | [máj.te] | María Teresa |
| *Semi* | [sé.mi] | José Miguel |
| *Juanma* | [xwán.ma] | Juan Manuel |
| *Juanra* | [xuán.ra] | Juan Ramón |
| *Jime~Mena* | [xí.me]~[mé.na] | Jimena |
| *Alfon* | [ál.fon] | Alfonso |
| *Fer* | [fér] | Fernando |
| *Fernan* | [fér.nan] | Fernando |
| *Nando* | [nán̪.d̪o] | Fernando |
| *Josema* | [xo.sé.ma] | Jose Manuel |
| *Chema* | [t͡ʃé.ma] | Jose Manuel |
| *Manu* | [má.nu] | Manuel |

A rather modern tendency has evolved in Peninsular Spanish whereby a trochaic foot pattern emerges in compound names even when the second part of the compound name is precluded. For example, the name *José Luis* is often pronounced *Jóse Luis* in order to parse the first part of the compound name as a trochaic foot. Upon eliminating the second name, primary stress remains over the first syllable *Jóse*, in effect creating a trochaic foot [xó.se], where originally there was not one.

The process of segment insertion in certain Spanish diminutive forms provides further evidence to support the foot as an autonomous, yet interdependent component of prosodic structure. In the following example, the adjunct segments [eθ] insert between the prosodic base and the diminutive suffix in order that the output adhere to a minimum foot requirement in specific diminutive forms. Notice that in all the cases, the same result is obtained; all diminutive forms of disyllabic words containing penultimate diphthongs and monosyllabic words ending in a consonant are uniformly parsed into two binary feet:

[6] All the forms listed as truncated names are attested forms produced by Spanish speaking children.

(7) Infixation in Spanish diminutive forms

| | | | | |
|---|---|---|---|---|
| *huevo* | [weβ] + ito | *huevecito* | [wè.β] e.θí.to | 'egg' |
| *sol* | [sol] + ito | *solecito* | [sò.l] e.θí.to | 'sun' |
| *reina* | [rejn] + ita | *reinecita* | [rèj.n] e.θí.ta | 'queen' |
| *mes* | [mes] + ito | *mesecito* | [mè.s] e.θí.to | 'month' |

The common factor which unites the cases of segment insertion in some Spanish diminutive forms is the fact that the stems, upon positioning the final vowels [o,a] to the right margin of the diminutive suffix, are all bimoraic monosyllables. In diminutive forms of trisyllabic stems with penultimate diphthongs, however, insertion does not occur, substantiating the claim for a minimum foot requirement in certain diminutive forms:

(8) Lack of insertion with trisyllabic bases containing alternating diphthongs

| | | | | |
|---|---|---|---|---|
| abuelo | [a.βwél] + ito | *abuelito* | [a.βwè.l]í.to | 'grandfather' |
| huérfano | [wér.fan] + ito | *huerfanito* | [wèr.fan]í.to | 'orphan' |
| cigueña | [θi.ɣwéɲ] + ita | *cigueñita* | [θì.ɣweɲ]í.ta | 'stork' |

It is intuitively apparent that a strong preference for syllables to be parsed into trochaic feet is intimately associated to segment insertion in certain Spanish diminutive forms.

Studies in first language acquisition provide additional proof to substantiate the claim that foot structure is represented grammatically. Allen & Hawkins (1980), Blasdell & Jensen (1970), Echols & Newport (1992) and Wijnen *et al.*'s (1994) research show a remarkable association between unstressed syllables and deletion by language learners in their primary years of acquisition. Importantly, it has been observed that in trochaic languages, Spanish being among them, there is a patent tendency toward deletion of *unfooted* syllables. Thus in a word like *zapato* [θa.[pá.to]] 'shoe', for example, the first syllable, [θa], is left unfooted, and is therefore more susceptible to deletion by children in their formative stages of phonological acquisition. The final two syllables, [páto], on the other hand, form a trochaic foot, and are hence more impervious to deletion.[7] Lexicalized examples of this process are also quite common in Spanish: *ñora* (from *señora*, Hisp. Am., 'lady') and *chacha* (from *muchacha* 'girl'). It has been proposed that the language learner forces her output to align to language-specific stipulations regarding the shape and organization of metric feet, having deduced the constraints associated with foot structure from her input data (Demuth & Fee 1995; Fikkert 1994; Pater 1997).

On a final note, a common *language* form similar to Pig Latin spoken by Spanish speaking children provides a persuasive argument espousing the organization of metrical units as a fundamental function of the Spanish grammar. The language is formed by inserting an extra syllable, composed of an onset

[7] The astute reader will notice that insertion of extra syllables will satisfy this condition as well. In fact, this author's own daughter during her primary years of acquisition produced a form *zapatoto* [θà.pa.tó.to].

[p] and the same vowel which appears in the preceding syllable, between each syllable which appears in the Spanish input. Hence, a word *pelota* 'ball' becomes *pepelopotapa*. Although many forms of this language exist, the data in the following example come from a *dialect* known as *Sipisnopus* spoken by this author's native Spanish-speaking family from the island of Romblón in the Philippines:

(9) a. Spanish:
*Tiró la pelota contra la pared*.
'(He/she) threw the ball against the wall'.
(ti.ɾó) la pe(ló.ta) kon̲t̲ra la pa(ɾéð).

b. Sipisnopus:
*Tipilopo lapa pepelopotapa conpotrapa lapa paparedpe*.
(tí.pi)(ló.po)(lá.pa)(pé.pe)(ló.po)(tá.pa)(kóm.po)(tɾá.pa)(lá.pa)
(pá.pa)(ɾé.pe).

Regardless of the stress patterns which emerge in the Spanish input, words in the Sipisnopus output always surface in perfectly parsed trochaic templates.

# 2 Projection of stress on the grammar

## 2.1 Shape of feet

The organization of syllables into feet is a complex system involving constraints which first require individual words to be footed, and once accomplished, restrictions that define the shape and size of these feet. Additionally, a subsequent operation is required which determines how this configuration is superimposed over syllabic structure.

A constraint PARSE-SYLL, dealing expressly with metrical feet, has been proposed in the literature:

(10) PARSE-SYLL
Syllables must be parsed into feet.

Unlike syllabic parsing, the parsing of syllables into feet is not a steadfast rule in Spanish. If it were, we would not find unparsed feet. In OT, this means that nonconforming foot structures must be justified by hierarchical ranking. For the remainder of this article, the validity of PARSE-SYLL is substantiated by a typology of Spanish stress assignment based on hierarchical ranking.

In theory, the dominant position of PARSE-SYLL will always choose footed syllables over unfooted syllables:

(11)

| Input: /pato/ | PARSE-SYLL |
|---|---|
| ☞ a. [páto] | |
| b. pato | *! |

Although this constraint is capable of expressing the fact that footed words are preferred to unfooted ones, no stipulation is made which defines what type of foot is ultimately favored. In previous sections distributional evidence was provided which suggests that trochaic feet are by and large the most common foot structure in Spanish. It was mentioned that this point can be accounted for in an OT framework by way of a dominant position for TROCHEE.[8]

Notice that all divergent foot structures are eliminated by the interaction of PARSE-SYLL and TROCHEE:

(12)

| Input: /pato/ | TROCHEE | PARSE-SYLL |
|---|---|---|
| ☞ a. [pá.to] | | |
| b. [pa.tó] | *! | |
| c. pato | | *! |
| d. [pá]to | | *! |
| e. pa[tó] | | *! |

Tableau (12) illustrates that the dominant position of TROCHEE will always select binary feet which position stress over the leftmost syllable. Correspondingly, stress assignment in 88% of the vowel-final paroxytone words in Núñez Cedeño & Morales-Front's (1999) data can be justified by a similar model headed by TROCHEE.

Nevertheless, in order to arrive at a faithful typology of Spanish foot structure alternative stress patterns must also be considered. Consider the word *balcón* 'balcony' in which primary stress falls over the rightmost final syllable. To explain this structural divergence, it must be assumed that some higher ranked constraint dominates TROCHEE.

Here two constraints to justify degenerate foot structure will be reviewed. First, a constraint based on quantity which requires heavy syllables to be stressed will be examined. Subsequently, a correspondence constraint will be considered which requires lexically accented syllables to be stressed in the output.

Numerous studies in Spanish Phonology have suggested an intimate correlation between syllable weight and stress application.[9] One of the most important, if not controversial, is Harris (1983), in which this author proposes a quantity-sensitive analysis of productive stress application in Spanish. More recently, this concept has been incorporated into productive models of stress application from a constraint-based approach. And although different nuances of the same basic argument can be found in the literature to justify the emergence of stress over bimoraic syllables, all converge on the same essential point; heavy syllables must be stressed. Hammond (1999) proposes the following constraint:

(13) Weight to Stress (WSP)
Stress heavy (bimoraic) syllables.

[8] In our analysis, we will consider all binary feet to be trochaic. As we shall see, monosyllabic feet are also possible in Spanish.

[9] Alonso-Cortés (1997) gives a thorough review of these works. Holt's (1997) doctoral thesis as well provides an interesting perspective on the issue. We will not take this matter up at this point.

(Hammond 1999)

If WSP were to occupy a dominant position, relative to a constraint which requires feet to be disyllabic, *Foot Binarity* (FtBin), EVAL would be obliged to select the candidate which assigns stress over the final heavy syllable of a disyllabic word, even if this implies leaving the first syllable unparsed:

(14) FtBin
Feet must be disyllabic.

Observe how this conflict would play out in the following tableau:

(15)

| Input: /balkon/ | WSP | FtBin |
|---|---|---|
| ☞ a. [bal.kón] | | * |
| b. [bál.kon] | *! | |

In this tableau, the optimal candidate, candidate (a) is chosen based on its satisfaction of WSP, which requires stress to fall on heavy syllables even at the cost of presenting a monosyllabic foot. Candidate (b) supplies a trochaic foot, but in this case WSP, which requires stress to emerge over heavy syllables, constitutes a dominant priority, rendering candidate (b) sub-optimal. Below, the validity of an analysis based on quantity is addressed.

Although Harris (1983) purports that Spanish stress is weight-sensitive, empirical evidence supporting this claim is quite weak (Alonso-Cortés 1997). One only needs to consider the English loan words *Wáshington*, *Rémington*, and *Bádminton*, as well as names such as *Mánchester*, *Róbinson* and *Thómas* to know that this claim is unsubstantiated by the data record. Bárkányi's (2002) experimental work as well proves that quantity is no longer a determining factor in productive stress assignment in Spanish. In her study, native Spanish-speaking informants were asked to judge the fitness of stress application in a variety of tri-syllabic nonse words. Among the syllable patterns represented were closed medial syllables flanked on each side by open syllables. In these cases stress appeared over the first open syllable: CV́.CVC.CV. Only 27% of the informants rejected outright this type of stress pattern, while a surprising 31% accepted the form without hesitation. Remarkably, CV́C.CVC.CVC words were accepted by a surprising 30% of the informants while another 30% found them suspect but suitable

Harris' claim for weight-sensitive stress application is further challenged by Trubetzkoy's universal, quoted in Roca (1988, 417): «in order for a VC rhyme to be counted as heavy, the language must also have V: rhymes». Since vowel length became neutralized in the transition between Latin and Spanish, the generalization that heavy syllables must be stressed so too was lost.

It is true that in Latin stress was incontrovertibly sensitive to syllable weight. In the case that the penultimate syllable was heavy, stress appeared systematically over this syllable, while, in cases to the contrary, stress appeared over the

syllable immediately preceding, the preantepenult. However, when length contrast was lost in Romance, the proclivity to systematically stress closed heavy syllables became futile.

Burzio (1994) disputes that vowel length has been totally lost in Modern Spanish, claiming that stressed vowels, like the [a] in *zapáto* [θapáto] 'shoe' is lengthened slightly due to stress application. Monroy-Casas' (1980) spectrographic data, however, reveal no such lengthening, effectively disproving Burzio's claim. Importantly, Monroy-Casas' experiments found no proof to support any correlation between stress application and vowel length.

Although, many heavy syllables in Spanish do, in fact, receive primary stress, here it will be assumed that stress application over non-trochaic heavy syllables is an inherited relic leftover from the Latin stress rule. In other words, stress-by-weight is an inactive concept in Modern Spanish. If heavy syllables are stressed in Spanish, it is due to one of two factors: (1) the syllable is penultimate and stress applies by default in order to satisfy TROCHEE, or (2) stress has been lexicalized over the heavy syllable due to a once active quantity-sensitive rule of stress application no longer valid in Modern Spanish.

For the remainder of this article, all non-trochaic stress patterns are considered to result from a dominant correspondence constraint which requires surface stress to coincide with an underlying lexical accent, FAITH-v̊.

The argument on which FAITH-v̊ is founded is that certain words have an underlying accent programmed into their lexical categorization. These are always expressed orthographically in Spanish. So for example, words like *café* 'coffee', *rondó* 'rondeau', *menú*[10] 'menu' and others, are lexically marked for an accent over the final vowel.[11] Stress application in trisyllabic words in which primary stress applies over the first syllable, *médulo* 'marrow, spinal cord', *péndulo* 'pendulum', and *pétalo* 'petal' for example, can also be justified by this same basic proposal.

Lexical accent is expressed by placing a «˚ » over the accented vowel in the underlying representation. If FAITH-v̊ is ranked dominantly to FtBin, correspondence principles will require the emergence of stress over the corresponding vowel even though the result implies a monosyllabic accented foot:

(16) FAITH-v̊
Accented vowels must be stressed.

The following tableau demonstrates this interaction:

(17)

| Input: /menů/ | FAITH-v̊ | FtBin |
|---|---|---|
| ☞ a. me.[nú] | | * |
| b. [mé.nu] | *! | |

[10]Other examples certainly exist. We chose these because they are of foreign origin and provide sound evidence that lexical accentuation forms part of the phonological essence of the word structure.

[11]In these cases, the underlying stressed vowels unquestionably form part of the stem (Roca 2006).

As is apparent, the superior ranking of FAITH-v̊ overrules any desire expressed by FtBin for feet to be disyllabic, and therefore trochaic.

## 3 Foot alignment

In this section, the alignment of feet to the syllable is considered and a series of generalized alignment constraints will be proposed in order to produce optimal outputs. In Spanish, feet are generally aligned to the rightmost word margin. This explains why penultima syllables are considerably more susceptible to stress assignment in Spanish:

(18) *mariposa* 'butterfly'
[mà] [ɾi] [pó] [sa]
/ ⇑ \
[ F O O T ]

This fact can be expressed with a constraint RL, which stipulates that the right edge of feet must align to the right word margin. Here, Σ is used to refer to *foot*:

(19) RL (General Alignment)[12]
Align (Σ, R, Word, R); the right edges of all feet are aligned with the right edge of the word.

Unranked, this constraint can already account for stress patterns in words such as textitzapato 'shoe', in which primary stress is assigned over the penultima syllable. Observe:

(20)

| Input: /θapato/ | RL |
|---|---|
| ☞ a. θa.[pá.to] | |
| b. [θá.pa.]to | *! |

As the reader will notice, RL forces all right edges of feet to align to the rightmost edge of the word. The divergent alignment in candidate (b) implies that stress must apply over the first syllable [θa], a sub-optimal strategy.

For polysyllabic words in which stress falls on the penultima syllable, RL is capable of rendering the correct output. Appreciably, though, not all tri- and polysyllabic Spanish words follow the same stress pattern exhibited in (18). Consider an example textitestímulo 'stimulus' in which the right foot margin cannot possibly align to the rightmost word edge since this would erroneously require stress to apply over the penultimate syllable: esti[mú.lo]. A constraint, NonFinality, has been suggested and examined[13] in the literature

[12]This constraint is akin to All-Ft-Right presented by McCarthy & Prince (1993). The difference between All-Ft-Right and RL is inconsequential.
[13]See Hammond (1999) and Kager (1999) for a full review of NonFinality.

which penalizes candidates that align right edges of feet with the right edge of a word:[14]

(21) NonFinality
*Σ
|
Word

The dominant ranking of NonFinality in relation to RL will yield the proper foot alignment for an input /estı̊mulo/. Consider the following conflict resolution between RL and a dominant NonFinality:

(22)

| Input: /estı̊mulo/ N[15] | NonFinality | RL |
|---|---|---|
| a. es.ti.[mú.lo] | *! | |
| ☞ b. es.[tí.mu]lo | | * |
| c. [és.ti].mu.lo | | **! |

Upon ranking RL to a position in which its stipulations are only minimally binding, foot alignment is free to deviate from the right edge requirement, in effect justifying divergent foot positions in non-trochaic stress patterns in Spanish.

## 4 A typology of Spanish stress

In this section it is asserted and shown that all stress patterns in Spanish non-verbs can be explained by the interaction of the previous constraints which regulate the shape and alignment of feet. A typology which justifies stress application in all Spanish non-verbs based on the hierarchical ranking of these few key constraints is offered below.

Consider once again the constraints examined up to this point:

(23) *Constraint sets*[16]
Shape constraints: PARSE-SYLL, FtBin, FAITH-ů.
Assignment constraints: PARSE-SYLL, RL/LR, NonFinality.

Following Hammond (1999), a set of all possible rankings for these constraints is provided:

(24) Logically possible rankings of shape constraints
a. PARSE-SYLL ≫ FAITH ≫ FtBin
b. PARSE-SYLL ≫ FtBin ≫ FAITH

[14] Roca (2006) presents an argument that in Spanish feet align not to the right *word* edge, but rather to the right *stem* edge. In our analysis, however, we find such a distinction unnecessary.

[15] We make explicit the fact that our input is a noun, since the verb form estimulo (1st pers. sing. *to stimulate*), in which stress falls over the penultimate syllable, also exists.

[16] It is unclear the extent to which these constraint sets interact.

c. FAITH ≫ FtBin ≫ PARSE-SYLL
d. FAITH ≫ PARSE-SYLL ≫ FtBin
e. FtBin ≫ FAITH ≫ PARSE-SYLL
f. FtBin ≫ PARSE-SYLL ≫ FAITH

All possible combinations of alignment constraints appear in the following:

(25) Logically possible rankings of assingment constraints
a. RL/LR ≫ NonFinality ≫ PARSE-SYLL
b. NonFinality ≫ RL/LR ≫ PARSE-SYLL
c. RL/LR ≫ PARSE-SYLL ≫ NonFinality
d. PARSE-SYLL ≫ RL/LR ≫ NonFinality
e. PARSE-SYLL ≫ NonFinality ≫ RL/LR
f. NonFinality ≫ PARSE-SYLL ≫ RL/LR

## 4.1 Analysis of Spanish non-verb data

The following data are divided by the number of syllables and the types of stress each group of like-numbered syllables will accept. The analysis begins with disyllabic tokens and increments progressively up to four-syllable words. The data set is restricted to monomorphemic words.

Assimilated loan words are intentionally considered in the following data set. Past studies have excluded such items to the peril of presenting an incomplete sample of the facts from Spanish stress application. However, this current study is concerned with the productive Spanish grammar and how the grammar computes stress. Seen in this way, assimilated words provide a wealth of knowledge regarding how Spanish speakers process a new input, and the generalizations which shape the Spanish-accented output.

It must be specified that this study examines only non-verbs. This is an important distinction since, contrary to Harris' (1989; 1995) claims, stress assignment in verbs and non-verbs entail vastly different competing forces. It is generally accepted that stress application in Spanish verbs is morphologically generated and highly prescriptive, whereas the allocation of non-verb stress is somewhat capricious and less systematic in nature (Roca 2006).

On a final note, the default foot structure in Spanish is assumed to be trochaic. The natural consequence, as illustrated in the following section, is that any deviation from TROCHEE must be motivated by a dominant FAITH-v̊ constraint which justifies the maintenance of lexical accent in the surface form.

Consider the following data:

(26) Disyllabic words [σσ]

a. σσ́
Closed accented syllables[17]

| | | |
|---|---|---|
| Nouns | | |
| *balcón** | [bal.kón] | 'balcony' |
| *pared* | [pa.ɾéð] | 'goodness' |
| *vigor* | [bi.ɣóɾ] | 'vigor' |
| *hotel* | [o.tél] | 'hotel' |
| *revés* | [re.βés] | 'reverse' |
| *perdiz** | [peɾ.ðíθ] | 'partridge' |
| *bazar* | [ba.θáɾ] | 'bazaar' |
| Adjectives | | |
| *truhán*[18] | [tru.án] | 'shameless' |
| *ardid** | [aɾ.ðið] | 'astute' |
| *astur** | [as.túɾ] | 'Asturian' |
| *atroz* | [a.tɾóθ] | 'fierce' |
| *sutil* | [su.tíl] | 'subtle' |

Open accented syllables

| | | |
|---|---|---|
| Nouns | | |
| *sofá* | [so.fá] | 'sofa' |
| *café* | [ka.fé] | 'coffee' |
| *carné* | [kaɾ.né] | 'permit, ID card' |
| *tabú* | [ta.bú] | 'taboo' |
| *rondó* | [roɲ.ɖó] | 'rondeau' |
| Adjectives | | |
| *hindú*[19] | [iɲ.ɖú] | 'hindu' |

b. σ́σ
Closed accented syllables

| | | |
|---|---|---|
| Nouns | | |
| *cisne* | [θís.ne] | 'swan' |
| *horno* | [óɾ.no] | 'oven' |
| *compra* | [kóm.pɾa] | 'purchase' |
| *susto* | [sús.to] | 'fright' |
| *pasta* | [fál̪.t̪a] | 'lack' |
| *cárcel* | [káɾ.θel] | 'jail' |

[17]Notice that some words have both syllables closed. These are marked with an asterisk.
[18]From French *truand* 'shameless'. The astute reader will notice that nearly all the adjectives which appear in this category are either rare glosses in Spanish, not commonly used in Modern Spanish, or of foreign origin. This theme is repeated in this category throughout all the data sets.
[19]From French *hindou* 'hindu'.

| | | |
|---|---|---|
| *cóndor* | [kón.doɾ] | 'condor' |
| Adjectives | | |
| *gordo* | [góɾ.ðo] | 'fat' |
| *triste* | [tɾís.te] | 'sad' |
| *lento* | [lén̪.t̪o] | 'slow' |
| *zurdo* | [θúɾ.ðo] | 'left handed' |
| *calmo* | [kál.mo] | 'calm' |

Open accented syllables

| | | |
|---|---|---|
| Nouns | | |
| *nata* | [ná.ta] | 'heavy cream' |
| *globo* | [gló.βo] | 'balloon' |
| *clase* | [klá.se] | 'class' |
| *taxi* | [ták.si] | 'taxi' |
| *tribu* | [tɾí.bu] | 'tribe' |
| *lunes* | [lú.nes] | 'Monday' |
| *iris* | [í.ɾis] | 'iris' |
| *crimen* | [kɾí.men] | '(capital) crime' |
| *cráter* | [kɾá.teɾ] | 'crater' |
| *túnel* | [tú.nel] | 'tunnel' |
| *líder* | [lí.ðeɾ] | 'leader' |
| Adjectives | | |
| *cojo* | [kó.xo] | 'lame' |
| *majo* | [má.xo] | 'nice' |
| *fino* | [fí.no] | 'elegant' |
| *mudo* | [mú.ðo] | 'mute' |
| *útil* | [ú.til] | 'useful' |
| *cutis* | [kú.tis] | 'skin' |

Contrary to the proposal presented in Harris (1983) supporting a quantity-sensitive analysis of Spanish stress, the open/closed contrast supplied in the previous data set is intended to highlight the distributional evidence which proves there is no functional correlation between stress and syllable weight in Modern Spanish. That is to say, light, open syllables can be stressed even when coinciding in words in which a heavy, closed syllable is left unstressed, confirming that a quantity-sensitive analysis of productive stress application is not at all supported by the Spanish data. It is true that, frequently, heavy syllables in Spanish do indeed attract stress, but it is not supplied productively by an operative function of the production grammar. In these cases stress emerges due to a strong proclivity to maintain lexical accent in the surface form, or by mere coincidence in heavy syllables which represent the leftmost syllable of a trochaic foot.

In order to justify the [σσ́] stress pattern in (26a), it has already been mentioned that FAITH-v̊ must play a crucial role in determining the optimal output, but the specific constraints which are necessarily violated in order to satisfy

this restriction have not been considered. To recall, final stress implies an indisputable violation of PARSE-SYLL, since the first syllable is left unfooted. It can therefore be assumed that PARSE-SYLL will be ranked to the inferior position of the constraint hierarchy. Additionally, final stress violates FtBin by not providing a binary foot. Consider the following constraint hierarchy. For now, the ranking of FtBin in relation to PARSE-SYLL will be presumed to be inconsequential, since both must be violated to satisfy FAITH-v̊:

(27) FAITH-v̊ ≫ FtBin , PARSE-SYLL

Observe their interaction in the following tableau:

(28)

| Input: /paɾe̊d/ | FAITH-v̊ | FtBin | PARSE-SYLL |
|---|---|---|---|
| a. [pá.ɾeð] | *! | | |
| b. [pá].ɾeð | *! | * | |
| ☞ c. pa[ɾéð] | | * | * |

Although candidate (c) incurs a violation of the two subordinate constraints, it does so in order to satisfy the requirement that lexical accent be maintained in the optimal output. Candidate (b) neither parses both syllables of the word into binary feet nor applies stress over the lexically stipulated syllable. This is the least optimal strategy. Candidate (a) parses the word into a binary foot, but at the cost of not maintaining underlying stress over the final syllable, incurring a fatal violation of the superior constraint of the hierarchy.

Open syllables which receive final stress are treated in an identical way. This hierarchy is offered again in the following example:

(29) FAITH-v̊ ≫ FtBin , PARSE-SYLL

These constraints interact in the following tableau:

(30)

| Input: /menů/ | FAITH-v̊ | FtBin | PARSE-SYLL |
|---|---|---|---|
| a. [mé.nu] | *! | | |
| b. [mé].nu | *! | * | |
| ☞ c. me[nú] | | * | * |

Here, the monosyllabic stressed final foot proposed by candidate (c) is optimal since this strategy satisfies the dominant constraint of the hierarchy, FAITH-v̊. The logical side effect of satisfying FAITH-v̊, however, implies a necessary infraction of FtBin and PARSE-SYLL, an acceptable concession given the present hierarchical organization of the constraints.

In turning to the examples provided in (26b), stress assignment coincides with the stipulations made by TROCHEE, the default stress pattern in Spanish. That is not to say, however, that all examples from (26b) will receive the same treatment with regard to the hierarchical organization of the constraints that govern stress application. In words such as *nata* [ná.ta] 'heavy cream',

*gordo* [gór.ðo] 'fat', *pato* [pá.to] 'duck' etc. in which trochaic stress emerges productively, FAITH-σ́ cannot in principle occupy an important position in the hierarchy since its effects are null in productive stress application. In fact for now, this constraint will be omitted altogether.

In assimilated loanwords such as *líder* [lí.ðeɾ] 'leader', *túnel* [tú.nel] 'tunnel', and *cráter* [krá.teɾ] 'crater', however, FAITH-σ́ must assume a dominant position since stress does not apply over the first syllable due to any specific penchant to maintain trochaic stress, but rather to maintain the underlying accent supplied by the input.

Consider the word *nata* [ná.ta] 'heavy cream'. Given that both syllables are of the type CV, stress applies *productively* over the first syllable, [ná], by default to satisfy principles preferring trochaic stress. The same result could likewise be obtained by claiming that stress applies over this syllable to satisfy FAITH-σ́, implying that stress in these words is lexical. But the problem with this proposal is that the justification for trochaic stress in words that fit this, and similar, syllabic models would be reduced to simple maintenance of lexical accent at the surface level. Seeing that trochaic stress is one of few active processes in Spanish for which there exists consistent empirical evidence, the inclusion of FAITH-σ́ is unwarranted, since this would imply that there were no productive process governing stress application in Spanish. Essentially, it would have to be assumed then that all stress is memorized by the language learner, incurring an obvious and unfounded burden on the speaker's long-term memory.

The following hierarchy is proposed in order to justify the emergence of productive trochaic stress. Notice that the ranking of FtBin and PARSE-SYLL is inconsequential due to the disyllabic nature of the inputs in this data set:

(31) FtBin ≫ PARSE-SYLL

(32)

| Input: /gordo/ | FtBin | PARSE-SYLL |
|---|---|---|
| ☞ a. [gór.ðo] | | |
| b. [góɾ].ðo | *! | * |
| c. goɾ.[ðó] | *! | * |

In this tableau, candidate (a) is the optimal output since it satisfies all the constraints in the hierarchy. All other candidates are eliminated by proposing outputs which contain monosyllabic feet.

In certain cases such as in the English loanwords *póster*, *máster*, *túnel*, *líder*, etc. a reasonable case can be made in favor of the maintenance of lexical accent as proposed by FAITH-σ́. Notice that stress assignment in these tokens is exceptional since native Spanish words ending in [ɾ,l] always receive stress over the final syllable. Thus it is argued here that the appearance of stress in these cases is not governed by any productive inclination to generate a trochaic output, but rather by the proclivity to maintain underlying accent in the output. The following hierarchy will capture this generalization:

(33) FAITH-σ́ ≫ FtBin , PARSE-SYLL

The previous hierarchy expresses that only syllables which carry lexical accent in the input may surface with stress. Notice how this hierarchy predicts the proper output:

(34)

| Input: /pǒster/ | FAITH-v̌ | FtBin | PARSE-SYLL |
|---|---|---|---|
| ☞ a. [pós.teɾ] | | | |
| b. [pós]teɾ | | *! | * |
| c. pǒs[téɾ] | *! | * | * |

As is obvious, a hierarchy dominated by FAITH-v̌ is capable of justifying the exceptional maintenance of stress in both naturalized and unnaturalized loan words, even if the cost implies a compulsory infraction of the usual tendencies which govern stress application in the receiving language.

Now, let us consider the trisyllabic data:

(35) Trisyllabic words [σσσ]

a. σσσ́[20]

Closed accented syllables

| | | |
|---|---|---|
| Nouns | | |
| *capitán* | [ka.pi.tán] | 'captain' |
| *neceser* | [ne.θe.séɾ] | 'toiletry case' |
| *estrangul* | [es.tɾaŋ.gúl] | 'mouth harp' |
| *patatús* | [pa.ta.tús] | 'fainting fit' |
| *aguarrás* | [a.gwa.ɾás] | 'paint thinner' |
| *avestruz* | [a.βes.tɾúθ] | 'ostrich' |
| *animal* | [a.ni.mál] | 'animal' |

Open accented syllables[21]

| | | |
|---|---|---|
| Nouns | | |
| *alajú* | [a.la.xú] | 'biscuit' |
| *alamí* | [a.la.mí] | 'small bench' |
| Adjectives | | |
| *carmesí* | [kaɾ.me.sí] | 'crimson' |

[20] As one will surely notice, the longer the words are becoming the more exceptional and/or odd the forms in this category seem. Meaning alone, discarding momentarily the form, indicates that a few of these forms are unknown even to Spanish speakers. Nevertheless, all forms here are registered with the Real Academia Española as Spanish words, some being *naturalized* Spanish words.

[21] We draw attention to the fact that trisyllabic nouns and adjectives ending in stressed vowels are quite hard to come by, yet verbs regularly end in tonic [ó], [í], [é] depending on their thematic classification.

b. *σόσ*
Closed accented syllables

| | | |
|---|---|---|
| Nouns | | |
| *recuerdo* | [re.kwér.ðo] | 'sounvenir' |
| *demanda* | [de.mán̪.d̪a] | 'demand' |
| *suspenso* | [sus.pén.so] | 'failure' |
| *asfalto* | [as.fál̪.t̪o] | 'asphalt' |
| *lagarto* | [la.ɣár.to] | 'lizard' |
| Adjectives | | |
| *difunto* | [di.fún̪.t̪o] | 'difunct' |
| *presunto* | [pre.sún̪.t̪o] | 'presumed' |

Open accented syllables

| | | |
|---|---|---|
| Nouns | | |
| *zapato* | [θa.pá.to] | 'shoe' |
| *patata* | [pa.tá.ta.] | 'potato' |
| *resumen* | [re.sú.men] | 'summary' |
| *artritis* | [aɾ.tɾí.tis] | 'arthritis' |
| *hipnosis* | [ip.nó.sis] | 'hypnosis' |
| Adjectives | | |
| *acates* | [a.ká.tes] | 'loyal' |
| *sensate* | [sen.sá.to] | 'sensitive' |
| *hermoso* | [eɾ.mó.so] | 'beautiful' |
| *caníbal* | [ka.ní.βal] | 'cannibal' |

c. *όσσ*
Closed accented syllables

| | | |
|---|---|---|
| Nouns | | |
| *péndulo* | [pén̪.d̪u.lo] | 'pendulum' |
| *lástima* | [lás.ti.ma] | 'pity' |
| *máscara* | [más.ka.ɾa] | 'mask' |
| *víspera* | [bís.pe.ɾa] | 'eve' |
| *ómnibus* | [óm.ni.βus] | 'omnibus' |
| *ángulo* | [áŋ.gu.lo] | 'angle' |
| *ínterin* | [íɲ.t̪e.ɾin] | 'interim' |
| *Mánchester* | [máɲ.t͡ʃes.teɾ] | 'Manchester, U.K.' |
| Adjectives | | |
| *plástico* | [plás.ti.ko] | 'plastic' |
| *póstumo* | [pós.tu.mo] | 'postumous' |

Open accented syllables

| | | |
|---|---|---|
| Nouns | | |
| *regimen* | [ré.xi.men] | 'diet' |

| | | |
|---|---|---|
| *ático* | [á.ti.ko] | 'attic' |
| *ácido* | [á.θi.ðo] | 'tribe' |
| *médula* | [mé.ðu.la] | 'medula' |
| *pétalo* | [pé.ta.lo] | 'petal' |
| *modulo* | [mó.ðu.lo] | 'module' |
| *época* | [é.po.ka] | 'era' |
| *ómicron* | [ó.mi.kɾon] | 'omicron' |
| *Wáshington* | [wá.ʃiɲ.ʈon] | 'Washington' |
| *Remington* | [ré.miɲ.ʈon] | 'Remington – typewriter' |
| Adjectives | | |
| *lúcido* | [lú.θi.ðo] | 'lucid' |
| *clásico* | [klá.si.ko] | 'classic' |
| *plácido* | [plá.θi.ðo] | 'placid' |
| *trágico* | [tɾá.xi.ko] | 'tragic' |
| *módico* | [mó.ði.ko] | 'moderate' |
| *cómodo* | [kó.mo.ðo] | 'comfortable' |

There is a marked paradigmatic unity between stress application, and its constraint-based explanation of trisyllabic oxytones and that of their disyllabic counterparts. In fact, no change at all to the original ranking schema presented earlier to justify stress assignment in disyllabic oxytones is necessary to account for the foot structure presented in the new data set.

To recall, the explanation of oxytone stress patterns was based on the notion that lexical accents must be retained in the output. Of course, the desire to maintain lexical accent in the surface form opposes the fundamental stipulations expressed by FtBin, since satisfying FAITH-v̊ necessarily obliges the parsing of a monosyllabic final foot and incurs a critical violation of FtBin. Indeed, this is the general development which emerged in the examples from (26a) when FtBin was ranked subordinate to FAITH-v̊. Naturally, this paradigm also posed certain challenges to PARSE-SYLL since the remaining syllables in the word were left unfooted.

The one negligible modification which will have to be made in this present analysis, however, is to explicitly rank PARSE-SYLL superior to FtBin. Recall that in the hierarchy treating the emergence of final stress in disyllabic inputs, these constraints were interchangeable to a certain extent due to the disyllabic character of the inputs. Nevertheless, in this hierarchy, PARSE-SYLL must dominate FtBin since this latter is violated by the optimal output while the former is not. The amended hierarchy is presented in the following example:

(36) FAITH-v̊ ≫ PARSE-SYLL ≫ FtBin

Observe how this constraint hierarchy is capable of producing the optimal stress patterns:

(37)

| Input: /abestruθ/ | FAITH-v̊ | PARSE-SYLL | FtBin |
|---|---|---|---|
| a. [á.βes]tɾuθ | *! | * | |
| b. a[βés.tɾuθ] | *! | * | |
| ☞ c. [a.βes][tɾúθ] | | | * |
| d. [a][βés.tɾuθ] | *! | | * |
| e. a.βes.tɾuθ | *! | *** | |
| f. [a][βes][tɾúθ] | | | **!* |

(38)

| Input: /alamı̊/ | FAITH-v̊ | PARSE-SYLL | FtBin |
|---|---|---|---|
| a. [á.la]mi | *! | * | |
| b. a[lá.mi] | *! | * | |
| ☞ c. [a.la][mí] | | | * |
| d. [a][lá.mi] | *! | | * |
| e. a.la.mi | *! | *** | |
| f. [a][la][mí] | | | **!* |

Now a paradigm of constraints must be programmed in order to justify foot alignment. In the previous analysis of the data in (26), this was an inconsequential factor due to the disyllabic input structure. For the trisyllabic data in (35), however, it is quite necessary.

The fact that stress applies over the final syllable indicates that NonFinality cannot possibly occupy an important position in the assignment hierarchy. Conversely, it can be assumed that RL must rank dominantly since it is routinely satisfied by the optimal output. Finally, PARSE-SYLL will occupy the medial position in this new hierarchy.

The following hierarchy of assignment constraints to justify foot alignment in trisyllabic oxytones is proposed:

(39) RL ≫ PARSE-SYLL ≫ NonFinality

Their interaction can be observed in the following tableau:

(40)

| Input: /abestruθ/ | RL | PARSE-SYLL | NonFinality |
|---|---|---|---|
| a. aβestɾuθ | | **!* | |
| b. (á)βestɾuθ | *!* | ** | |
| c. (a.βés)tɾuθ | *! | * | |
| d. (á).βès.tɾuθ | *!* | ** | |
| ☞ e. à.βes.(tɾúθ) | | ** | * |

In this tableau, the optimal output, candidate (e), only completely satisfies RL. Its one fewer violations of this constraint is decisive in the determination of optimality. Identical results are obtained when a trisyllabic input with a stressed final vowel is substituted.

Next, attention must be turned to the shape constraints which produce the optimal outputs found in (35b), in which stress is assigned over the middle

syllable. Remember that in the hierarchy presented in (31), FtBin and PARSE-SYLL were interchangeable, since both were satisfied circuitously as a result of the disyllabic structure provided by the input. Observe how the hierarchy proposed to justify paroxytone stress in disyllabic words will compute stress in the trisyllabic examples:

(41) FtBin ≫ PARSE-SYLL[22]

Consider the following tableau:

(42)

| Input: /asfalto/ | FtBin | PARSE-SYLL |
|---|---|---|
| ☞ a. as[fál.to] | | * |
| ☞ b. [ás.fal]to | | * |
| c. [as.fal][tó] | *! | |
| d. [as][fál.to] | *! | |
| e. [as.fál.to] | *! | |
| f. asfalto | | *!* |

Although there is no programmed generalization which predicts the specific syllable which will ultimately be left unfooted, this hierarchy determines that one of the feet will not be parsed, since doing so would result in a fatal violation of FtBin, an inacceptable strategy. This is not an important predicament, however, since only the shape of the foot is of concern here. Later, a set of assignment constraints will account for the foot's alignment.

Candidates (a) and (b) satisfy the dominant two constraints while only incurring an insignificant violation of PARSE-SYLL, the inferior constraint of the hierarchy. Candidates (c) through (e) are all discarded by FtBin, either by proposing a foot which is monosyllabic or by grouping the three syllables into one impossible foot.

Now, in considering the assignment constraints which justify the position of the foot in the words found in (35b), again, NonFinality cannot occupy the dominant position since it is routinely violated by the optimal output. PARSE-SYLL as well is prohibited from occupying the superior position of the hierarchy since the first syllable is left unfooted. In this case, RL will assume the superior position and PARSE-SYLL will be demoted to the middle position. NonFinality will remain in the lowest rank since it is systematically violated by the optimal output. This hierarchy and its corresponding tableau appear in the examples that follow:

(43) RL ≫ PARSE-SYLL ≫ NonFinality

[22]Words with no heavy syllable can be justified by TROCHEE.

(44)

| Input: /θapato/ | RL | PARSE-SYLL | NonFinality |
|---|---|---|---|
| a. (θá)pàto | *!* | | * |
| b. (θápa)to | *! | * | |
| ☞ c. θa(páto) | | * | * |
| d. (θàpa)(tó) | *! | | * |
| e. (θa)(pa)(to) | **!* | | * |

Candidate (a) is eliminated by not aligning a foot to the right edge of the word. Candidate (b) as well ignores this stipulation and is accordingly eliminated from the evaluation process. Candidate (c) is the optimal candidate even though it violates the two inferior constraints of the hierarchy. Its satisfaction of the highest ranked constraint is enough to qualify this output as the winning candidate. Candidate (d) falls short of aligning a foot to the right margin of the word and is therefore deemed sub-optimal. Finally, candidate (e) is eliminated by RL for not aligning a binary foot with the right edge of the word.

To calculate the emergence of stress over the first syllable of the trisyllabic examples, interestingly, the initial hierarchy presented to justify the forms found in (26a) is already equipped with the proper theoretical mechanisms by which to predict the optimal outputs in (35c). Observe what happens when a token form is presented from (35c) into the initial hierarchy presented in (29). This hierarchy is presented a second time below:

(45) FAITH-v̊ ≫ FtBin ≫ PARSE-SYLL

(46)

| Input: /pe̊ndulo/ | FAITH-v̊ | FtBin | PARSE-SYLL |
|---|---|---|---|
| a. [pe̊n̊du][lo] | | *! | |
| b. [pe̊n̊][d̊ulo] | | *! | |
| c. pe̊n̊[d̊úlo] | *! | | * |
| ☞ d. [pe̊n̊du]lo | | | * |
| e. [pe̊n̊d̊ulo] | | *! | |
| f. pe̊n̊d̊ulo | *! | | *!** |

Candidate (d) emerges as the optimal output by satisfying the dominant two constraints while only violating the lowest ranked PARSE-SYLL. Candidates (a), (b) and (e) all parse mono- or poly-syllabic feet, committing a fatal infraction of FtBin. Candidate (c) satisfies this constraint but does not align the foot to the correct syllables, which, in turn forces a fatal violation of FAITH-v̊.

In order to assign the foot to the correct syllables, two minor provisions to the hierarchy presented to justify the foot assignment of trisyllabic words with medial stress will need to be made. This constraint hierarchy appears below:

(47) RL ≫ PARSE-SYLL ≫ NonFinality

In the new hierarchy, however, NonFinality will be ranked dominantly since the optimal output never violates this constraint. RL, which in the prior

case was ranked dominantly, must be demoted to the most inferior position of the new hierarchy since the foot does not align to the right edge of the word in the optimal output:

(48) NonFinality ≫ PARSE-SYLL ≫ RL

(49)

| Input: /reximen/ | NonFinality | PARSE-SYLL | RL |
|---|---|---|---|
| a. reximen | | **!* | |
| b. (ré)ximen | | **! | ** |
| c. re(xí.men) | *! | * | * |
| ☞ d. (ré.xi)men | | * | * |
| e. (ré)(xì.men) | *! | | * |

Candidate (d) emerges as the optimal output by satisfying the dominant constraint, while committing fewer infractions of the inferior constraints than the other remaining candidates.

As for polysyllabic words, [σσσσ], only two different stress patterns will be considered, [σσ.σ́σ], [σ́σσσ], since these are the only two patterns which emerge in monomorphemic Spanish words, although some Americanisms do exist in which stress falls over the final syllable of a four-syllable word: *maracuyá* 'passion fruit'.

Observe the following data:

(50) Polysyllabic words[23] [σσσσ]

a. σσσ́σ[24]
Closed accented syllables

| | | |
|---|---|---|
| Nouns | | |
| *vagabundo* | [bà.ɣa.βún̪.d̪o] | 'vagabond' |
| Adjectives | | |
| *estupendo* | [es.tu.pén̪.d̪o] | 'stupendous' |

[23] We limit our discussion here to four syllable words because stress can only maximally appear up to the third syllable. Words with more syllables, though, are certainly possible, such as *albaricoque* (apricot). However, the quantity of syllables does not constitute a new stress *pattern*. That is to say that stress may still only appear within the three syllable window as proposed by Harris (1983) and later interpreted by Roca (2006).

[24] As one will surely notice, the longer the words are becoming the more exceptional and/or odd the forms in this category seem. Meaning alone, discarding momentarily the form, indicates that a few of these forms are unknown even to Spanish speakers. Nevertheless, all forms here are registered with the Real Academia Española as Spanish words, some being *naturalized* Spanish words.

Open accented syllables[25]

| Nouns | | |
|---|---|---|
| *mariposa* | [mà.ɾi.pó.sa] | 'butterfly' |
| *maravilla* | [mà.ɾa.βi.ja] | 'marvel' |

b. *σόσσ*
Closed accented syllables

| Nouns | | |
|---|---|---|
| *arándano* | [a.ɾáɲ̪.d̪a.no] | 'blueberry' |
| *albóndiga* | [al.bóɲ̪.d̪i.ɣa] | 'meatball' |
| Adjectives | | |
| *romántico* | [ro.máɲ̪.t̪i.ko] | 'romantic' |
| *fantástico* | [faɲ̪.t̪ás.ti.ko] | 'fantastic' |
| *espléndido* | [es.pléɲ̪d̪.di.ðo] | 'splendid' |

Open accented syllables

| Nouns | | |
|---|---|---|
| *estímulo* | [es.tí.mu.lo] | 'stimulus' |
| *escrúpulo* | [es.kɾú.pu.lo] | 'scruple' |
| *obstáculo* | [obs.tá.ku.lo] | 'obstacle' |
| *vestíbulo* | [bes.tí.βu.lo] | 'vestibule' |
| *oxígeno* | [ok.sí.xe.no] | 'oxygen' |
| Adjectives | | |
| *intrépido* | [in.tɾé.pi.ðo] | 'intrepid' |
| *insípido* | [in.sí.pi.ðo] | 'insipid' |
| *ridículo* | [ri.ðí.ku.lo] | 'ridiculous' |
| *metículo* | [me.tí.ku.lo] | 'meticulous' |

Predictably, the parsing of the polysyllabic syllables into binary feet is easily expressed using an identical paradigm of constraints used to justify all the trochaic forms in this section. To begin with the forms in (50a), the constraint FtBin, which mandates that all feet be composed of two syllables, must be ranked dominantly. Later, PARSE-SYLL requires all syllables to be parsed into feet. These constraints are presented in hierarchical form below:

(51) FtBin ≫ PARSE-SYLL

Observe their interaction in the following tableau:

[25]We draw attention to the fact that trisyllabic nouns and adjectives ending in stressed vowels are quite hard to come by, yet verbs regularly end in tonic [ó], [í], [é] depending on their thematic classification.

(52)

| Input: /bagabundo/ | FtBin | PARSE-SYLL |
|---|---|---|
| ☞ a. [bà.ɣa][βún̪.d̪o] | | |
| b. [bá.ɣa]βun̪.d̪o | | *!* |
| c. ba[ɣá.βun̪]d̪o | | *!* |
| d. ba.ɣa[βún̪.d̪o] | | *!* |
| e. [ba][ɣa.βun̪][d̪o] | *!* | |

Candidate (a) emerges optimal by satisfying all constraints in the hierarchy. Its closest competition comes from candidates (b), (c) and (d) which fall short of optimality by not parsing all the syllables into feet, for which these candidates accrue two violation marks each for PARSE-SYLL. Candidate (e) is eliminated by the dominant constraint, FtBin, by presenting two monosyllabic feet.

Alignment of the feet is a fairly straightforward matter. It is intuitively obvious that NonFinality must assume an inferior position in this hierarchy since it is routinely violated by the optimal output. RL must occupy the dominant position followed in middle position by PARSE-SYLL, since this latter constraint can only be satisfied if feet are perfectly aligned to the right word edge. Notice, however, that from a functional perspective, the ranking of RL in relation to PARSE-SYLL is inconsequential in this hierarchical organization:

(53) RL ≫ PARSE-SYLL ≫ NonFinality

Observe the following tableau:

(54)

| Input: /mariposa/ | RL | PARSE-SYLL | NonFinality |
|---|---|---|---|
| a. mariposa | | **!** | |
| b. (má.ri)posa | *!* | ** | |
| c. (ma.ri)(po)sa | *!** | * | |
| ☞ d. (màri)(pósa) | | | * |
| e. mari(pó.sa) | | *!* | * |

Candidate (d) is the optimal output since it fully satisfies PARSE-SYLL and RL, the superior constraints of the hierarchy. All other candidates are eliminated by one or more violations of these two constraints.

Next, the shape constraints which justify the preantipenult stress pattern in the polysyllabic examples found in (50b) must be considered. FAITH-v̊ must play a dominant role in the hierarchical organization of constraints, followed by FtBin and PARSE-SYLL in descending order:

(55) FAITH-v̊ ≫ FtBin ≫ PARSE-SYLL

Contemplate the following tableau:

(56)

| Input: /arån̪dano/ | FAITH-v̊ | FtBin | PARSE-SYLL |
|---|---|---|---|
| a. [àr.an̪][d̪á.no] | *! | | |
| ☞ b. a[ɾán̪.d̪a] no | | | ** |
| c. a[ɾán̪][d̪a.no] | | *! | * |
| d. [a][ɾán̪][d̪a.no] | | *!* | |
| e. aran̪d̪ano | *! | | **** |

As it would be expected, the hierarchy responsible for aligning the foot to the base must be dominated by NonFinality, since stress cannot simultaneously fall on the second syllable of a polysyllabic word and satisfy constraints which align the foot to the rightmost word margin. Naturally, judging by the optimal output, RL must assume the inferior position of the hierarchy since it is systematically violated by the optimal output. This constraint will prove decisive, however, in determining the optimal output in spite of its subordinate ranking. Finally, PARSE-SYLL will assume the middle position. Consider the following hierarchy and tableau:

(57) NonFinality ≫ PARSE-SYLL ≫ RL

(58)

| Input: /bestı̊bulo/ | NonFinality | PARSE-SYLL | RL |
|---|---|---|---|
| a. bestiβulo | | *!*** | |
| b. (bés.ti)βulo | | *!* | ** |
| c. (bés.ti)(βu)lo | | * | *!* |
| d. (bès.ti)(βú.lo) | *! | | |
| ☞ e. (bès)(tí.βu)lo | | * | * |

Here, candidate (e) results optimal by a slim margin, only one fewer violations of RL than candidate (c). Candidate (a) is eliminated by leaving all syllables unparsed, whereas candidate (b) is eliminated by leaving two unfooted syllables. Candidate (d) is excluded by a fatal violation of NonFinality.

# 5 Conclusions

The predictions regarding the justification of Spanish stress application based on the interaction of constraints which govern the shape and alignment of feet are corroborated by the data presented above. A complete typology of the constraints is presented in the following table:

(59) Typology of stress in Spanish non-verbs

| | Syllable type | Hierarchical rankings | |
|---|---|---|---|
| | | Shape | Assignment |
| a. | *σσ́* | FAITH-v̊ ≫ FtBin, PARSE-SYLL | RL ≫ PARSE-SYLL ≫ NonFinality |
| b. | *σ́σ* | FtBin ≫ PARSE-SYLL | RL ≫ PARSE-SYLL ≫ NonFinality |
| c. | *σσσ́* | FAITH-v̊ ≫ FtBin, PARSE-SYLL | RL ≫ PARSE-SYLL ≫ NonFinality |
| d. | *σσ́σ* | FtBin ≫ PARSE-SYLL | RL ≫ PARSE-SYLL ≫ NonFinality |
| e. | *σ́σσ* | FAITH-v̊ ≫ FtBin, PARSE-SYLL | NonFinality ≫ PARSE-SYLL ≫ RL |
| f. | *σσσ́σ* | FtBin ≫ PARSE-SYLL | RL ≫ PARSE-SYLL ≫ NonFinality |
| g. | *σσ́σσ* | FAITH-v̊ ≫ FtBin, PARSE-SYLL | NonFinality ≫ PARSE-SYLL ≫ RL |

Seen in table form, some remarkable generalizations emerge with regard to stress patterns in Spanish. Concerning shape, stress assignment in all monomorphemic nouns and adjectives in Spanish can by justified using only two different constraint schemata. A similar paradigm is observed with respect to alignment. This type of paradigmatic effectiveness represents an important advantage of OT.

For the language learner, this type of typological consistency presents a real benefit. If it is true that stress is in our heads, as it were, then learning algorithms must be simple enough for a child in her phonological acquisition stage to be able to deduce the restrictions from the input data of her linguistic environment and subsequently rank them in order to produce an optimal output. The typology provided above would pose no problem for a language learner due to the simplistic nature of the hierarchical components and the systematic nature of their organization.

It was proposed that all non-trochaic stress is the result of a dominant correspondence constraint, FAITH-v̊, which obliges surface level stress to coincide with lexical accent. The one drawback of this analysis is that there is no way to predict nor justify the exact syllable over which stress must fall, meaning that the language learner must store a vast quantity of individual tokens, along with their corresponding lexical accents to memory. The resulting grammatical simplicity, though, which is gained by such a strategy provides a suitable and viable compensation for this extra burden on the memory.

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